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CORRELATION IN HIGH-SCHOOL SCIENCE COURSES

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Analysis of the problem of the proposed correlation of the natural science courses in the high schools discloses the need of distinguishing between the natural sciences and the newer studies which are competing against the sciences for place in the high-school program.

Is not the alleged increase in the number of science courses in the high school more apparent than real?

The facts seem to be that the recent vocational pressure has increased the number of *studies* rather than the number of natural *sciences*. Agriculture, commercial studies, household arts, manual training, etc., are not *sciences*. Agriculture is no more a science than manual training; household arts, no more than bookkeeping, shorthand, and typewriting. Why not face the fact? Cooking, carpentry, typing, sewing, forge-work, cabinet-making, agriculture, shorthand, horticulture, animal husbandry, etc., are not *sciences*.

Under the modern pressure of the vocational in high-school education these vocational arts have sought admission into the program of the high school. English, history, mathematics, and sciences were already seated there. Moreover, it had become the custom to count four as the high-school pupil's quota of studies. Where, then, should the entering wedge be inserted? By elimination, it fell to the lot of the sciences to receive the thrust. Cooking and sewing became household "science." Food production in its various arts also became "science." Thus by careless classification, under stress to find a place in the program, has arisen the idea that science courses have been greatly increased. The high-school sciences still remain botany, zoölogy, chemistry, physics, physiology, and physiography.

Readjustment of the high-school program to this vocational thrust can be easily brought about, not through elimination of subjects which are necessary for due consideration for all types of pupils, nor through syllabicated short-course combinations that grossly disregard the prevailing conviction as to the need of sustained, intensive study of each science undertaken.

The cry of overcrowded program arises by reason of the presumption that all pupils should study the same subjects. Just here is the menace of catching phrases and terms: "standardization," "uniformity," "stem courses," "general science," etc. These terms deceive. Certainly adolescents are sufficiently mature to begin selective study to accord with the type of individuality. Uniformity is justified in the studies of childhood by reason of the general nature of the training that is required; but uniformity must not be permitted to continue and hamper development of individuality, when the time plainly has come to differentiate school study to adapt it to individual ability, personal choice, and economic necessity. Standardization invents excuses; it is better to plan a program which will admit of the widest possible flexibility to fit as many types of individuality as possible.

Consequently to program the subjects in the high school into groups extending through the four years is an incompetent plan. High-school subjects offered should be grouped in single-year offerings. The four-year group plan requires the child at fourteen to forecast his future educational program for four years at least—an utter impossibility. Few, if any, children at this age can either know, or be competently investigated by another to find out, just what subjects should be chosen for as much as one year ahead, not to speak of the impossibility of knowing through the four-year span.

Upon his entrance into high school no more should be asked of any pupil than to be programmed for one year, the programming for the ensuing year being left to be done under the new disclosures of awakening natural ability, personal trends, and economic necessity.

Again, pupils who can attend the high school for but one year should be induced to attend at least that long for the betterment of their chances in life through education. This incentive will be found in a program that provides the pupils with a complete year of achievement independently of the subsequent year's work. It must be made certain that such pupils know that the single year of study as offered comprises a complete unit in itself, and not a less worthy fragment of some other unit which has value only when the succeeding year's work is completed.

The four-year step is an administrative outrage. Thorndyke in *Education*, page 136, says: "The system of forcing a crucial election of the bulk of four years' work upon the pupil at the very start encourages free, unintelligent election in its worst form. This so-called 'required' system is really a system of the most extended election of the whole course in a lump, and at the worst possible time, when the pupil can know nothing about the offering, and less than at any later time about his own capabilities."

The proposal to offer "stem," or "general," science courses to all high-school pupils antagonizes two essentials in high-school education:

1. These stem, or general, science courses comprise composite, brief abstracts from several sciences which are compressed into relatively unimportant brevity, shallow superficiality, and pretentious vacuity. At this time, so long after thirteen-week courses in sciences have been discarded because of the inadequacy of such brevity, it would be worse than disregard to indorse such modification of the discards as would change weeks to days! Rejection of the condensed compounds must follow.

The minimum essential year-course unit in each science is in accord with the findings of present experience. Intensive study of one science, protracted until the essentials in subject-matter have been learned and mastery of characteristic processes has been achieved, accords with the present view. The half-year course, even, is a subterfuge, maintained to make a showing of doing more than the actual facts warrant. The single-chapter courses which comprise the stem, or general, science courses are far worse and should not be countenanced.

2. That all high-school pupils should study the same course in "science" violates the fundamental requirement that individual differences and preferences must be regarded. Any competent investigation as to why pupils do not enter the high school, or, having entered, soon leave, discloses the verdict: "I do not care to study what is offered there." Regardless of the uncertainty of the pupil's line of reasoning, or of his avenue of information, whereby he determines his choice of studies or rejection of studies, it still remains true that a wide variety of studies must be offered if pupils are to be effectively appealed to by the high-school program.

The uniformity of the elementary school cannot be continued in the high school. If promoted pupils are to be induced to enter and to remain in the high school, individual ability, personal preferences, and family economic necessity must be met with a great variety of studies offered. The diversity in the college program rather than the cramping uniformity of the elementary school should be the model.

Just now during the transition of the high school from its former position as the uncommon school for the exclusively elect, to its destined place as an integral and indispensable part of the great common school of all the people, the high school must make the advances toward rapid and complete realization of the present trend. The appeal of the high school must win all pupils, not merely the few of traditional tendencies educationally. Until all parents are obessed with the call of the high school as the upper third of the common school of the common people and realize that the common school includes all the twelve grades, it is necessary to intensify the appeal to many parents by offering many different subjects in the earliest years of the high school.

Instead of a variety of science courses in the later years of the high school, the variety should be offered in the earlier years. The diminished enrolments in the upper years preclude variety of year-courses there. Ordinarily the enrolment is almost as large in the first year of the high school as in both the third and the fourth years.

Keeping in mind that the vocational subjects are not sciences, nor competent substitutes for the sciences, it is an easy matter to provide for both the sciences proper and for these vocational subjects in the program of year-courses offered in the high school.

Year-Courses for Ninth-Grade Pupils

ACADEMIC

- Algebra
- Botany
- English
- History
- Latin
- Modern Language
- Physiography

VOCATIONAL

- Agriculture
- Arithmetic
- Household Arts
- Mechanical Drawing

Year-Courses for Tenth-Grade Pupils

ACADEMIC

- English
- History
- Latin
- Modern Language
- Plane Geometry
- Physiology
- Zoölogy

VOCATIONAL

- Agriculture
- Bookkeeping
- Household Arts
- Manual Training

Year-Courses for Eleventh-Grade Pupils

ACADEMIC

- Chemistry
- English
- History
- Latin
- Modern Language
- Solid Geometry and Advanced Algebra

VOCATIONAL

- Agriculture
- Bookkeeping, Advanced
- Household Arts
- Manual Training

Year-Courses for Twelfth-Grade Pupils

ACADEMIC

- Civics and Economics
- English
- Latin
- Modern Language
- Physics

VOCATIONAL

- Agriculture
- Household Arts
- School Management and Teaching
- Stenography and Typewriting

Following the common 8 – 4 plan, and neglecting the 6 – 3 – 3 plan, for the sake of simplicity, the foregoing plan is basic for programming the year-courses offered into four groups each to correspond with its appropriate year or grade of the high school.

Agriculture should be offered in high schools which are mainly rural; in the strictly urban high schools a corresponding trade—the dominant one in the community—should be offered in its stead.

Each pupil is to be classed as fast, medium, or slow, according to his record in achievement. All fast pupils are to enrol in five year-courses, three of which at least are to be of the grade or year in which the pupil is registered; the other one or two may be selected from the grade-group next above or below the one in which the pupil is registered.

All medium pupils are to enrol in four year-courses, three of which at least are to be of the grade-group in which the pupil is registered; the fourth may be selected from the grade next above or below that one.

Slow pupils may enrol in three year-courses, if it is necessary to compensate thus for their lack of ability. One of the year-courses may be selected from the grade next above or below that in which the pupil is registered.

Fast pupils may be graduated after having credited out in fifteen year-courses; though they may elect to graduate after four years during which they have credited out in a minimum of nineteen year-courses.

Medium pupils may be graduated after four years provided they have credited out in sixteen year-courses.

Slow pupils are graduated after five years provided they have credited out in a minimum of seventeen year-courses.

A simple system of standards for determining the class—fast, medium or slow—to which each pupil belongs, and for advancing, or reducing to a lower class, has been worked out and will be outlined in case the desire is made known by any interested person.

Which of the year-courses in any grade shall be prescribed must be determined by the individual pupil's plan for a high-school education. This must be an individual matter, and not a prescription just for the love of domination. It is far more important to assist a pupil to discover his individual plan for a high-school education than to enforce a rigid system of prescriptions. To be concerned to show the pupil *his* way, having already made provision for that way, is a matter of far greater consequence than to be able to force the pupil to go *your* way regardless of the individual capabilities of the pupil, or because you have neglected to provide better.

The foregoing plan of high-school program of year-courses notably provides for the following, among other things:

1. Adequate recognition of individual differences in ability, preferences, and economic necessity; also sustained, programmed emphasis upon discovery of individual aptitudes.

2. Provision for whole year-courses by eliminating overcrowding. There is a place for as many year-courses as the school is able to offer. Additional year-courses may be introduced when the need arises, and those in vogue may be discontinued without disturbing the program in any particular.

3. Capable pupils are provided with sufficient work to keep them effectively occupied. Due recognition is given to the desirability of preparing such pupils quickly for the university should there be special reason why the pupil complete his university course as soon as possible. Moreover, the plan constitutes each fast pupil into an influential leader whose example in industry and achievement will mean much as an incentive to the pupils who require urging.

4. Slow pupils are not sacrificed upon the altar of repeated discouragement through not passing. The need of the slow pupils to take more time is recognized. Maturity may come to their rescue so that they become able to do work which was beyond their reach while they were younger.

5. The choice of studies is but for one year at a time. One year is a long way in the future of any youth. For the next years's choice he requires all the light which the preceding year shed upon his path. More information upon the question of the right choice of studies will be gathered through this necessity of keeping the question open than would be the case if the four-year leap into the dark were made under the other system of offering the studies in four-year groups.

6. Occasion is provided for the high school to enter the sphere of vocational training to the limit of the local means and aims. Under the other plan preparation for college stalls preparation for life. Vocational studies are lined up with life's needs should the pupil desire to go no farther than the high school.

7. The plan is elastic, also, in providing both for small and for large high schools. The high school in a thinly populated community need not shrink its studies down to mere pretenses. The local needs as well as the pupils' necessities can be regarded. Different types of communities are provided for also by this plan. The strictly rural school, the school in a strictly manufacturing center or commercial center, or other type can easily modify the plan to suit its needs without radical disturbance of the school's program.

Again, is a general preview through a so-called stem science course desirable for successful work in the later science courses?

If the differences between the different sciences are considered, such a general science course is no more needed than is needed a general language course as an introduction to the later study of more extensive courses in German, French, and Spanish.

A four-part general science course, composed of four one-year courses in four different natural sciences, is scarcely more than a preview in natural science. The day of multiplex superficiality in high-school education should be assisted in its passing.

Contrast these two preview courses in science: (1) a general science course comprising four full year-courses, viz., a ninth-grade year-course in one science, a tenth-grade year-course in another, an eleventh-grade year-course in a third, and a twelfth-grade year-course in a fourth science, with (2) a general science course embracing one year of one-month courses in nine different sciences!

Desultory glancing at the materials and dallying with the methods of a natural science should end abruptly with nature-study in the elementary school. This end should be abrupt, and not protracted through the first year of the high school, under the name of general, or stem, science. Sauntering along the childish pathway, strewn with miscellaneous scientific phenomena, noticing, now this, now that, as the flitting occasions present phenomenon after phenomenon, is not science study. Such flitting, changeful mental focusings do not justly conform to the adolescent mind. The earlier childish inconstancy in attention is first to be supplanted in the high school by appeals from selected special groups of natural phenomena programmed for more prolonged intensive study. Unassorted nature-study intensifies the childish mindedness so characterized by the disorganization of its knowledge. The mind of the high-school pupil is ready for the training that comes alone from intimate, sustained, selected, circumscribed, and intensified study in definite fields of science.

The high school can offer the fourteen-year-old mind no more edifying, transforming, and eventful treatment than to subject it to its first full year-course in one definite science. The unity of a year-course in one natural science, its progressive unfolding of phenomena, so susceptible of scientific classifying, and its sequential arrangement of facts and law, of objects and casual conditions, of acquisition and application, provide all necessary introductory preparation at the right juncture and under the right controls. Hence issue an associated solidarity, an organized unity in knowledge, a classified whole: in a word, a science.

There is a magic eventfulness, a profound educational begetting, a vigorous intellectual reaction in intensive, prolonged, special study of a single science. The high-school mind, at the fulness of its adolescent blooming, awaits at fourteen the fertilizing, energizing reactions of psychological pollen that is special, not general, sustained, not transitory, intensive and coherent, not extensive and chaotic. Desultoriness does not guarantee scientific unification. Hitting the striking high points gratifies a childish instinct for the novel, the outstanding; but it is for the adolescent mind, so teeming with anticipations of future needs, with hopes of future demands for trained minds, to qualify intensively so as to be found not wanting when the chosen field of enterprise at last is entered upon.

The stem courses proposed as a remedy for ignorance which is so conspicuous in the later year-courses in science will not meet expectations in this regard. The question why pupils, enrolled in a science year-course in the later years of the high school, do not learn in a satisfactory manner the assigned lessons through study-room and laboratory study, and under teaching guidance, may be much more easily and directly answered and managed than by proposing preparatory presentations in the preceding years. The same thing is noticeable in classes in every high-school year-unit. It also arises in the general science course as proposed. In a word, the real situation is this: Pupils do not competently learn and retain lesson assignments. What is needed is better immediate teaching rather than preparatory courses!

If a year's skimming over a later three-year field of subject-matter is deemed remediable, check it up by trying out a similar skimming at the first of a one year-course over the entire year's work as a preparation for the work to be done during the rest of the year. What will this do the pupils' interest?

On the other hand, if it were not for the increased cost for bindings, might it not be better to do in the science courses what is done in the study of English literature: use separate small volumes, each devoted to a whole sub-unit of the course, thus keeping the pupil in an attitude of interested expectation?

Previews jade interest by silencing the expectation of the novel. Why separate leaflets for readers are better for use than a whole reader collection in a single volume in the hands of the pupil from the first is evident. It is by no means certain, therefore, that what is aimed at in general science might, with better certainty, be more directly hit by an exactly opposite course of procedure.

The deficiencies in the pupils noticed in high-school teaching cannot be successfully ascribed to their preceding preparation; most generally such deficiencies are the common outcome of the immediate teaching. What is needed to remedy this condition is improvement of the immediate teaching, not planning to have it done before the teaching is supposed to be begun.